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Schossow

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[54] **CHIMNEY STACK EXHAUST UNIT**

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Related U.S. Application Data

[63] Continuation of Ser. No. 894,726, Apr. 10, 1978, abandoned.

[51] **Int. Cl.**[3] **E04F 17/02**

[52] **U.S. Cl.** **98/58;** 110/184; 415/116; 417/366; 417/371

[58] **Field of Search** ..... 417/366, 368, 369, 371; 98/58, 60; 110/184; 126/85 B; 415/98, 102, 116

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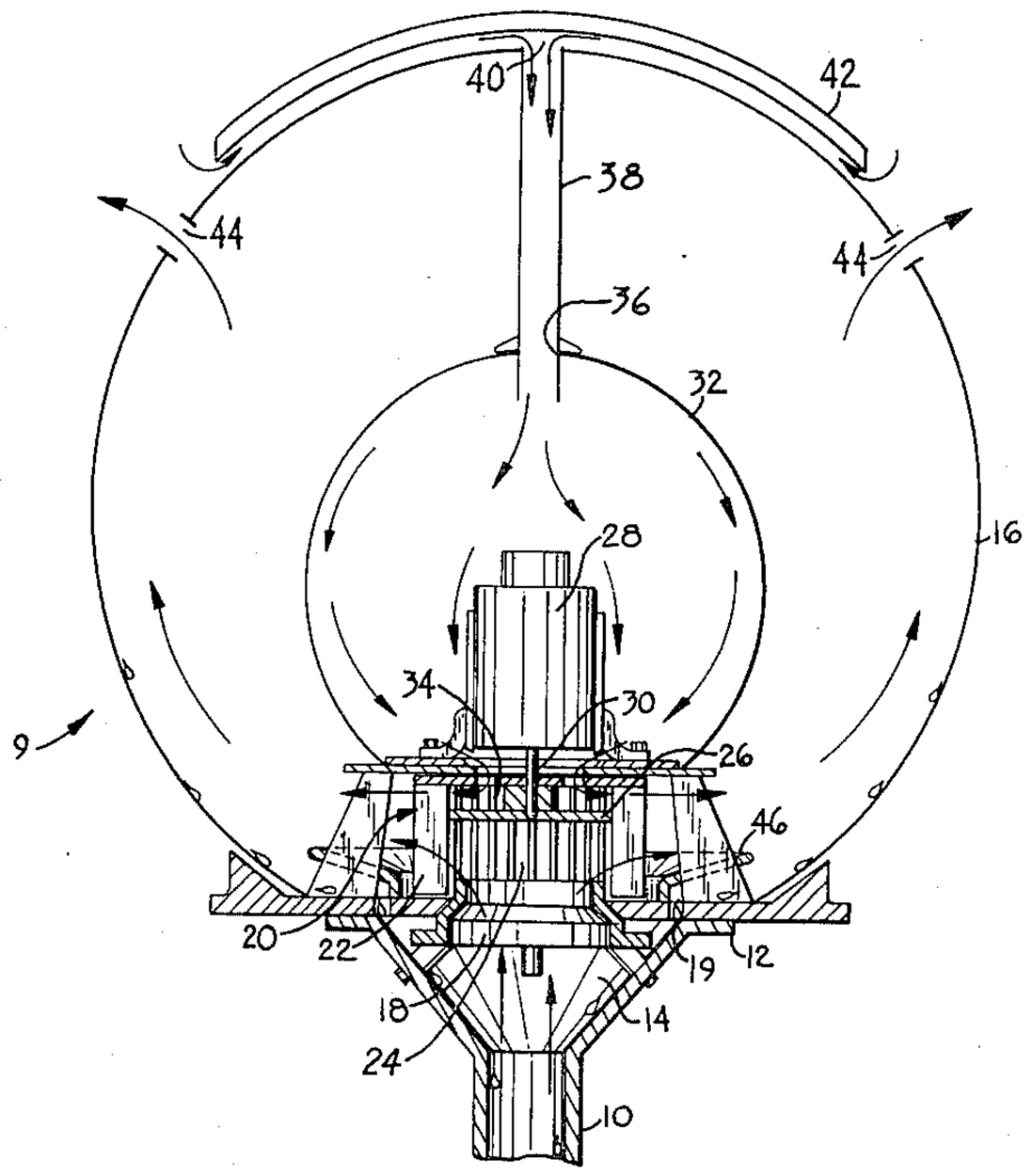
[57] **ABSTRACT**

A chimney stack exhaust treatment unit and an improved exhaust gas treatment system utilizing such a unit are disclosed. The unit comprises a generally spherical outer housing which fits over the mouth of a caustic-resistant chimney pipe and encloses a horizontally mounted squirrel cage fan which is driven by an electric motor situated above it. The fan is situated directly above the chimney mouth so that when it is rotated, exhaust gases are drawn up through the chimney and swirled around the inner walls of the outer housing. Exhaust ports near the top of the housing provide an exit for treated gas. An inner housing encloses a fan motor, isolating it from the interior of the outer sphere. A conduit connects an opening in the outer sphere with an opening in the inner housing, and the inner housing includes a mouth directly above the fan, whereby rotation of the fan also draws outside air through the inner housing to cool the motor.

8 Claims, 2 Drawing Figures



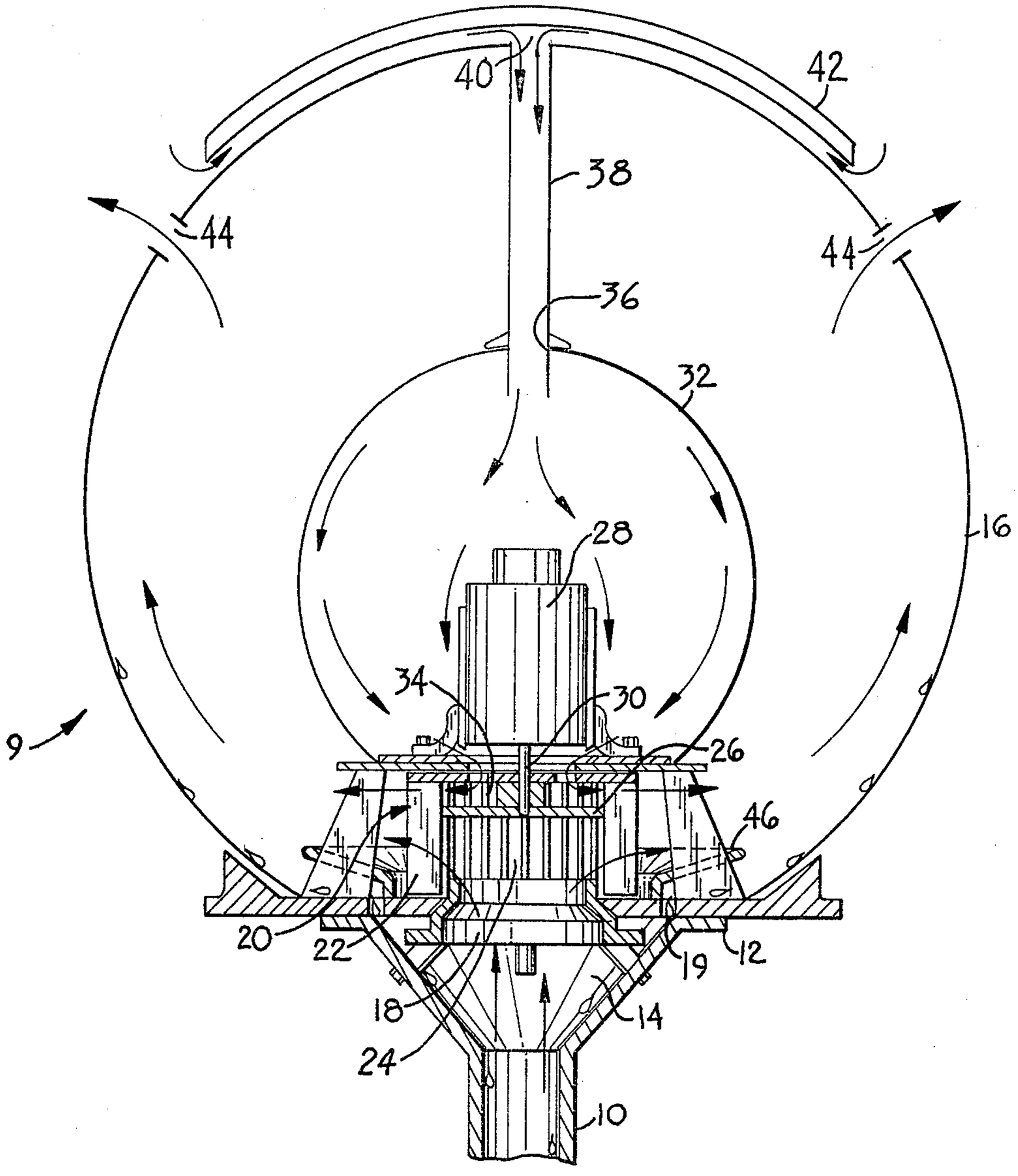


FIG. 1

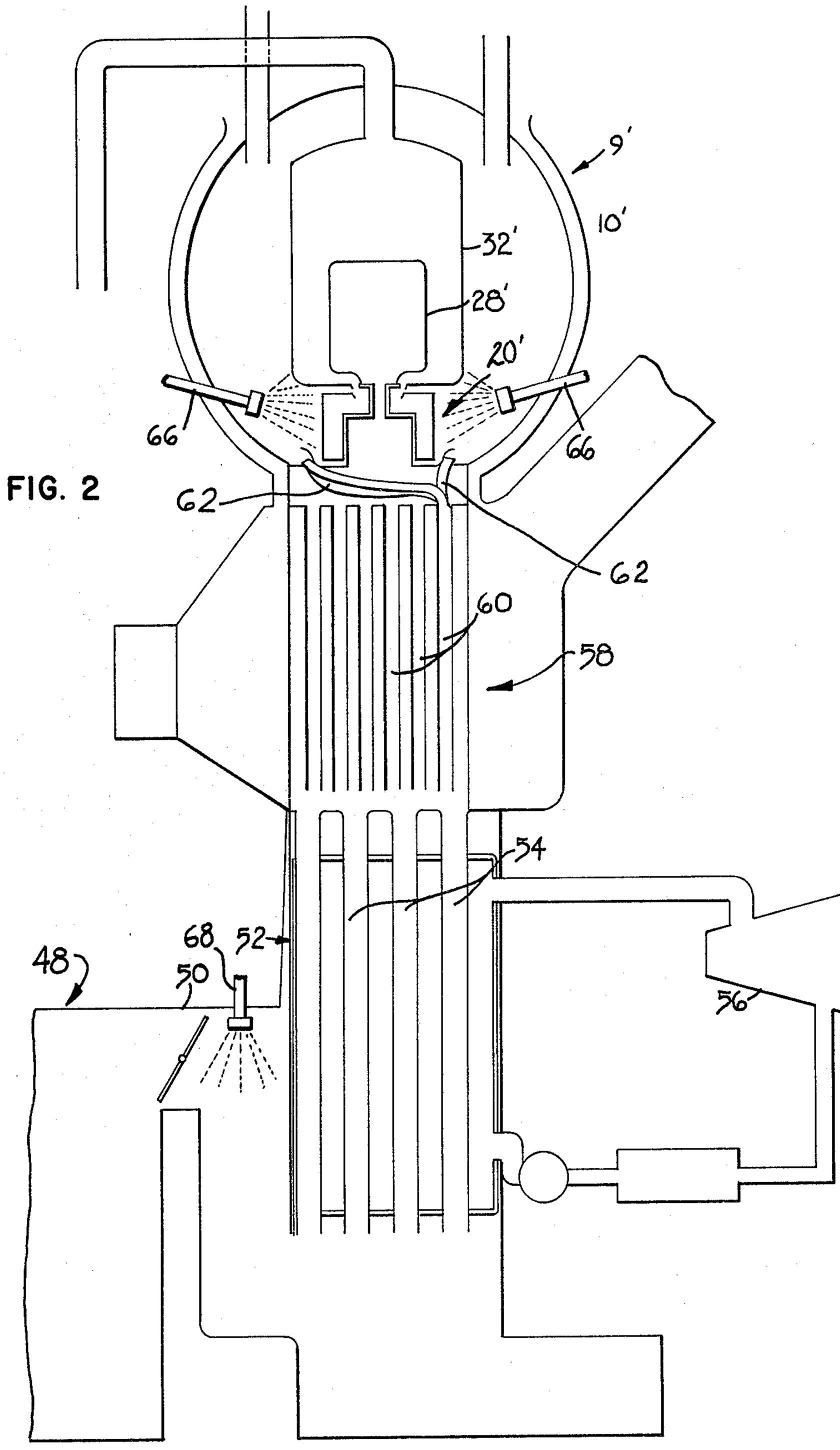


FIG. 2

CHIMNEY STACK EXHAUST UNIT

This is a continuation of application Ser. No. 894,726, filed Apr. 10, 1978, now abandoned.

BACKGROUND OF THE INVENTION

Field of the Invention

This invention relates generally to the field of energy retrieval and exhaust gas treatment systems. More specifically, this invention relates to chimney stack exhaust fan units.

Description of the Prior Art

In my co-pending patent application, Ser. No. 798,567, entitled "HEAT EXCHANGER," I disclose a system for preheating outside air to be used for combustion purposes in home heating systems and commercial, combustion-type power plants. The heat exchanger in that system comprises a plurality of vertical tubes carrying hot combustion gases from a combustion chamber to a chimney stack. The upward draft through the tubes is maintained by a fan mounted in the chimney outlet. Cold outside air, being carried to the combustion chamber, is passed around an upper portion of the heat exchanger tubes, thus preheating the combustion air and lowering the temperature of the exhaust gas within the tubes to the point that water vapor in the gas begins condensing out on the inner tube walls and running down them. Reaching the hotter, lower portions of the tube walls, the condensate again evaporates, rises, and recycles, scrubbing the exhaust gas of noxious pollutants as it recirculates. The condensate eventually runs out of the lower tube ends into a collecting chamber or drain pipe, and the scrubbed exhaust gas is drawn out of the chimney stack.

The previously described system utilizes a simple squirrel cage fan to induce a draft up the chimney. By replacing that fan with a unit which both induces a draft up the chimney, and removes the final bit of moisture from the exhaust gas, an improved pollutant scrubbing action and self-cleaning tube effect can be achieved. Heretofore, no device of which applicant is aware could achieve these effects.

SUMMARY OF THE INVENTION

The chimney stack exhaust treatment unit of the present invention comprises a standard squirrel cage fan and electric drive motor enclosed within a spherical globe which caps the chimney stack. As the fan is driven, it draws gas up the chimney and swirls it around the inner surface of the globe. The cold air surrounding the globe keeps the globe walls cool, providing a surface on which the remaining water vapor in the still relatively hot exhaust gas may condense. Drainage means at the bottom of the globe allow the condensate to flow back down the chimney stacks, providing a scrubbing function in the exhaust flow to remove pollutants. In the upper portion of the globe, a plurality of exhaust ports provides means of escape for cleaned exhaust gas.

An inner housing protects the fan motor from the corrosive action of exhaust gases. The inner housing is open along its lower portion to allow the fan to draw air downwardly through it, and includes an opening connected by means of a conduit to an opening in the outer globe, so that air drawn down through the inner housing is cool air from outside the outer globe.

The present invention thus provides a final treatment stage before exhausting gaseous products to the open air. It can be used effectively in home heating systems, as well as in commercial systems.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is an enlarged sectional view of the chimney stack unit of the present invention.

FIG. **2** is a view, partially schematic, showing the chimney stact unit of the present invention in combination with a heat exchanger and power plant.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings, FIG. **1** shown a chimney stack exhaust unit **9** for home use constructed in accordance with the present invention. Reference numeral **10** indicates a caustic resistant chimney stack pipe, constructed of material such as PVC. The walls of pipe **10** extend outwardly at the upper end of the pipe, terminating in annular flange **12**, defining the mouth **14** of chimney pipe **10**.

Mounted on flange **12**, above mouth **14** is outer sphere **16**, constructed of any suitable lightweight, caustic-resistant material—any one of a number of plastics would be appropriate. The lower portion of sphere **16** is provided with a lower opening **18** interfacing with chimney mouth **14**, to provide fluid communication between the chimney stack and the interior of sphere **16**. An annular drain opening **19** is also provided at the interface between sphere **16** and chimney pipe **10**.

Mounted within sphere **16**, immediately above openings **18** and **14**, is a squirrel cage-type fan unit **20**, the structure of which is well-known in the art. Unit **20** generally comprises a plurality of vertically oriented blades **22** which are fixed with respect to each other so as to generally define a hollow cylindrical unit. Unit **20** is mounted so that its axis of rotation is centered over chimney mouth **14**. When squirrel cage fan **20** is rotated, air is drawn into the hollow core portion **24** of the unit from above and below, and forced radially outward between blades **22**, as indicated by the air flow arrows in FIG. **1**.

A solid plate **26** divides core **24** into upper and lower portions, the upper portion having approximately one fourth the size of the lower portion, whereby four fifths of the capacity of fan **20** is used to pull air upwardly through chimney **10**, while one fifth of it capacity pulls air downwardly through the unit.

An electric motor **28** is mounted above fan unit **20**, and rotates unit **20** by means of drive shaft **30**. To protect motor **28** from the corrosive effects of the exhaust fumes being drawn into sphere **16**, a second, inner sphere **32** is mounted so as to encase motor **28** and isolate it from the interior of sphere **16**.

As is shown in FIG. **1**, inner sphere **32** is provided with a lower opening **34** which is positioned above fan unit **20** so that the upper one fifth of fan **20** draws air downwardly from the interior of sphere **32**. Sphere **32** is provided with an upper port **36**, which is connected via conduit **38** with an inlet **40** in the upper portion of outer sphere **16**, thus providing a pathway for cool, fresh, outside air to be drawn downwardly through sphere **32** to cool fan motor **28**. A protective plate **42** keeps rain or snow from entering inlet **40**. Also disposed about the upper portion of outer sphere **16** are a plurality of exhaust vents **44**, through which treated exhaust air is exited.

An annular splashguard **46** rings the lower portion of squirrel cage fan **20** to funnel condensate into drain opening **19**, and to protect fan blades **22** from this moisture.

FIG. **2** is a schematic representation of a commercial embodiment of a chimney stack exhaust unit of the present invention. In FIG. **2**, numeral **9'** refers to the chimney stack exhaust unit. Hot exhaust gases from a combustion type boiler, or like combustion unit **48** are exhausted via a duct **50** in to a first heat exchanger **52** comprising a plurality of vertically oriented tubes **54**.

First heat exchanger **52** is similar to that disclosed in my previously mentioned, co-pending patent application, with the exception that, rather than passing cold outside air over tubes **54**, they are enclosed in a water jacket, thus utilizing the hot exhaust gases to produce steam to power a turbine **56**, for whatever purposes are desired. It is to be understood that the heat from the exhaust gases can be put to any desired work. The turbine arrangement is merely representative of what may be done once heat has been recaptured and translated into work.

Connected in series with first heat exchanger **52** is a second heat exchanger **58**, which is also similar to that described in my co-pending patent application. In the case of FIG. **2**, this heat exchanger passes cold outside air over a plurality of vertically oriented exhaust tubes **60**, in order to preheat the air for combustion purposes, as was previously disclosed. Above second heat exchanger **58** is mounted chimney stack exhaust unit **9'**, which includes a double-walled outer sphere **10'** enclosing a squirrel cage type fan unit, **20'** and an isolation globe **32'** enclosing a drive motor **28'**.

In operation, hot exhaust gases enter a series of heat exchangers comprising vertically oriented tubes around which are passed cool air or water, and heat is extracted to perform various types of work. As the hot gases move up the tubes, and cool, moisture carried in that gas condenses out on the inside walls of the tubes and runs down them.

If the combustion fuel utilized in the burner system is oil, then there will be sufficient water vapor in the exhaust fumes passing upwardly into the stack exhaust unit **9'** to build up the water vapor concentration therein and eventually to condense out the water vapor on the cool spherical housing walls. The condensate will run downwardly into the drain pipes **62** and thus subsequent condensation and redistillation in exhaust unit **9'** and in tubes **60** is much like a "rain" effect, entraining any particulate matter, and scrubbing sulphurous gases from the exhaust fumes by the process of co-condensation.

In some systems, particularly commercial power plants, coal is burned rather than fuel oil, in which case less water vapor is present in the exhaust. To facilitate the final scrubbing stage in such systems, the stack exhaust unit **9'** may be equipped with water spray nozzles **66** to provide a swirl of water within the unit to entrain the final bit of pollutant in the exhaust before passing it out of the system. Additionally, water may be injected into the system upstream of heat exchanger **54** via a spray nozzle **68**, or similar means. Water injected into the flow of hot flue gases at this point will vaporize quickly and contribute to the "rain" effect within tubes **60**.

Finally, the process of fractional distillation may be carried out at the upstream end of first heat exchanger **52** by installing a stepped series of domed, glass plates (not shown) below the mouths of heat exchanger tubes **54** in the stream of hot exhaust gas. The liquid run-off from tubes **54** falls on the hot glass plates, resulting in the boiling off of water and the progressive concentration of sulphuric, sulphurous and nitric acid which finds its way to a collection tank. Ammonia or ammonium hydroxide can be bubbled through this concentrated solution to produce liquid fertilizer.

What is claimed is:

1. A chimney stack exhaust unit comprising:

(a) a first, generally closed, spherical housing having a top portion and a bottom portion, said housing including a first opening in said bottom portion adapted to fit over a chimney stack mouth, plurality of second, outlet openings spaced annularly about said top portion of the housing, and a third opening in said top portion;

(b) a squirrel cage fan mounted generally horizontally within the first housing above and adjacent to the first opening, whereby rotation of the fan draws exhaust air upwardly through the stack and forces said exhaust air outwardly and upwardly in a swirling motion around the inside walls of the first housing;

(c) an electric motor mounted within the first housing above the fan, and means connecting said motor and the fan whereby the fan may be driven by the motor;

(d) a second, generally closed housing having top and bottom portions mounted within the first housing and enclosing the motor, said second housing including a blower opening in said bottom portion directly above the fan, and an upper opening in said top portion; and

(e) a conduit extending between the upper opening in the second housing and the third opening in the first housing, whereby rotation of the fan draws air from outside the first housing into its third opening, downwardly through the conduit, into the second housing via its upper opening, and outwardly into the first housing via the lower opening in the second housing.

2. The chimney stack exhaust unit of claim **1** which further includes means for limiting the draft inducing capacity of the fan in such a way that a predetermined portion of the fan's capacity is utilized to draw cool air down through the second housing, and a second predetermined portion of the fans capacity is utilized to draw exhaust gases upwardly into the first housing.

3. The chimney stack exhaust unit of claim **2** which further includes baffle means mounted within the first housing adjacent the first opening for channeling condensate which runs down the housing walls away from the fan and down the first opening into the chimney stack.

4. The chimney stack exhaust unit of claim **3** which further includes means for preventing rain or snow from entering the first housing via the third opening therein.

5. The chimney stack exhaust unit of claim **4** wherein said first predetermined portion of the fan's draft inducing capacity is approximately 1/5 thereof and the second predetermined portion is approximately 4/5 of the total capacity of the fan.

6. A chimney stack exhaust unit, comprising:

(a) a first, generally closed, housing including a top portion, a bottom portion with a downwardly and inwardly sloping wall, and inside surfaces of said top and bottom portions, said bottom portion hav-

ing a first opening adapted to fit over a chimney stack mouth, and said top portion having a plurality of second openings spaced thereabout and a third opening;

(b) a second, generally closed, housing mounted within said first housing and including a top portion with an upper opening and a bottom portion with a lower opening spaced from said first opening in said first housing;

(c) means for conducting air outside first housing from said third opening into said second housing through said upper opening; and

(d) means for drawing exhaust air upwardly through the stack and forcing it outwardly and upwardly in a swirling motion around the inside surfaces of said first housing and for drawing air from outside said first housing through said third opening, downwardly through said conducting means into said second housing via said upper opening, and outwardly into said first housing through said bottom opening into confluence with the exhaust air.

7. The chimney stack exhaust unit of claim 6 wherein said drawing means comprises a motor driven squirrel cage type fan mounted generally horizontally within said first housing above and adjacent to said first opening and below and adjacent to said bottom opening in said second housing.

8. The chimney stack exhaust unit of claim 6 further comprising means for preventing rain or snow from entering said first housing through said third opening.

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